

4E 2989

Roll No. _____

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4E 2989**B.Tech. IV Semester (Main/Back) Examination - 2012****Electronics & Comm.****4EC5 Random Variables & Stochastic Processes****Time : 3 Hours****Maximum Marks : 80****Min. Passing Marks : 24****Instructions to Candidates:**

Attempt any **Five questions** selecting **one question from each unit**. All questions carry **equal marks**. (Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly.) Units of quantities used/calculated must be stated clearly.

Unit - I

1. a) A_1 and A_2 take turns in throwing of two dice, the first to throw I will be awarded prize. If A has first turn. Show their chances of winning one in the ratio 9:8. (8)
- b) State and prove Baye's Theorem. (8)

OR

- a) In a communication system a '0' or '1' is transmitted correctly with probabilities p_1 and p_2 respectively. Due to the noise in the channel, a '0' can be received as one or one can be received as '0' with probability P_3 . If a '1' is received what is the probability that 'a' '1' was transmitted. (6)
- b) The chance that a doctor will diagnose a disease correctly is 70%. The chances of death of a patient after correct is 35%. While after wrong diagnosis it is 80%. If patient dies after taking his treatment find the probability that he was diagnosed
- i) Wrongly
- ii) Correctly. (10)

Unit - II

2. a) The probability that a person will die in the time interval (t_1, t_2) is given by

$$P[t_1 \leq t \leq t_2] = \int_{t_1}^{t_2} f(t) dt.$$

$$\text{Where } f(t) = \begin{cases} 3 \times 10^{-9} t^2 (100 - t)^2 & ; 0 \leq t \leq 100 \\ 0 & ; \text{ elsewhere} \end{cases}$$

Determine

- i) The probability that a person will die between the ages 60 and 70.
- ii) The probability that he will die between those ages assuming he lived up to 60. (8)

- b) Prove for Binomial Distribution

$$\left[\frac{d\mu_r}{dp} + nr\mu_{r-1} \right] pq = \mu_{r+1}$$

also find first four central moments. (8)

OR

- a) Prove that Poisson Distribution is a limiting case of Binomial Distribution. (10)
- b) If the skulls are classified as A, B, C according as the index is 75, between 75 and 80. Over 80 find approximately (assuming Normal Distribution) the mean and SD of the series in which A are 58%, B are 38%, and C are 4% being given and (6)

$$f(z) = \frac{1}{\sqrt{2\pi}} \int_0^z e^{-x^2/2} dx \text{ then } f(0.20) = .08$$

$$f(1.75) = .46$$

Unit - III

3. a) The joint probability density function of a bivariate random variable (x, y) is given by

$$f_{xy}(x, y) = \begin{cases} \lambda(x+y) & ; 0 < x < 3, 0 < y < 3 \\ 0 & ; \text{ otherwise} \end{cases} \quad \lambda \text{ is a constant}$$

- i) Find the value of λ
- ii) Find the marginal probability density function of X and Y.
- iii) Are X and Y independent. (8)

- b) If X and Y are two independent exponential random variables with parameter 1. Let $U = X+Y$ and $V = X-Y$. Then find the joint and marginal probability density function of U and V. (8)

OR

- a) The useful life of a certain kind of tube is a random variable having the probability density

$$f_x(x) = \begin{cases} \frac{20000}{(x+1000)^3}, & x > 0 \\ 0 & \text{otherwise} \end{cases} \quad (8)$$

If two tubes operate Independently. Then find

- i) The joint probability density of X and Y.
ii) $P(X < 100, Y < 100)$
- b) Let X and Y are two independent random variables with probability density function $f_{x,y}(x,y)$ then find pdf of (i) $z = X+Y$ (ii) $z = XY$ (iii) $z = \frac{X}{Y}$ (8)

Unit - IV

4. a) Find M.g.f. of Normal Distribution and hence find the mean and variance of Normal Distribution. (8)
- b) Find coefficient of correlation for the following data

x	1	2	3	4	5	6	7	8	9
y	9	8	10	12	11	13	14	16	15

(8)

OR

- a) A random variable X having a following p.d.f. $f(x) = \frac{1}{2\alpha} e^{-\frac{|x-\alpha|}{\alpha}} - \infty < x < \infty$

Find

- (i) M.g.f. of X
(ii) $E(X)$
(iii) $V(X)$
- b) State and prove chebyshev's inequality. (8)

Unit - V

5. a) $X(t) = A \cos (w_0 t + \phi)$ is a random process where A and w_0 is a constant and ϕ is a uniform random variable over $(-\pi, \pi)$. Show that $X(t)$ is ergodic in both the mean and auto correlation function. (8)
- b) Let $\{X(t)\}$ and $\{Y(t)\}$ are two random processes given by
 $X(t) = U \cos (W_0 t + \theta)$ and $Y(t) = U \sin (W_0 t + \theta)$. Where U and W_0 are constants and θ is a random variable over $(0, 2\pi)$
- (i) Find the cross correlation function
- (ii) Verify $R_{XY}(-\tau) = R_{YX}(\tau)$. (8)

OR

- a) If $X(t)$ is a random process with constant mean μ and if $\bar{X} = \frac{1}{2T} \int_{-T}^T X(t) dt$ then $\{X(t)\}$ is mean ergodic provided $\text{Var } \bar{X} = 0$ as $T \rightarrow \infty$. (8)
- b) The auto correlation function of a random process is $R_X(\tau) = e^{-\tau^2/2\sigma^2}$. Find the power spectral density and the normalized average power content. (8)